Laser Wakefield Acceleration

Objective: Use multi-scale simulation to overcome lack of theory and help design laser driven plasma wakefield accelerators.

Implications: Offers promise of multi-GeV accelerators orders of magnitude smaller and less costly than current machines.

Accomplishments: 2- & 3D PIC simulations (VORPAL) successfully reproduce LWFA electron beam charge and energy observed in experimental shots.
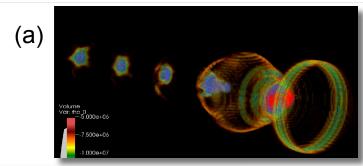
- Helped develop new injector technologies to improve beam quality in proposed 10 GeV LWFA
- Shows PIC code limitations - unphysical heating and macroparticle trapping.
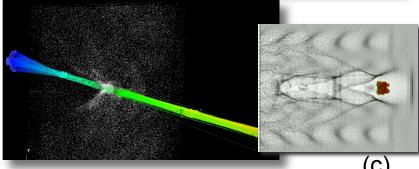
NERSC:

- 2.2M hours on Franklin; significant viz /analytics support; 50% of runs use ~10k cores

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(a)

(b)

(c)

(a) Volume rendering of plasma density with particles selected according to user-specified criteria shown in color; (b) particle trace of the selected particle bunch; (c) plasma particles trapped in the laser pulse wake with selected particles colored by momentum in the x-direction (red = high); non-selected particles shown in gray.

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